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**PRELIMINARY ASSESSMENT/
SITE INSPECTION
of
NEW JERSEY FIREWORKS**

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March 2001

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**Preliminary Assessment/Site Inspection
of
New Jersey Fireworks**

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Volume II Organic/Inorganic/Perchlorate Data Package and QA/QC Review

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1.0 INTRODUCTION

1.1 Authorization

This Preliminary Assessment/Site Inspection (PA/SI) was performed by the Maryland Department of the Environment, Waste Management Administration (MDE) under the 2000 Cooperative Agreement with the U.S. Environmental Protection Agency (EPA).

1.2 Scope of Work

MDE was contracted to perform a PA/SI of the New Jersey Fireworks Company, Inc. (NJF). The purpose of the PA/SI was to assess the actual and potential release of hazardous waste from the site by way of groundwater, surface water, soil and air pathways. The population and sensitive environments which may be impacted are discussed. The scope of the PA/SI included reviewing the available file information, a target survey, site reconnaissance and sampling under the U.S. EPA Contract Laboratory Program (CLP).

1.3 Executive Summary and Conclusions

The NJF site is located on Maryland Route 7 midway between the towns of Elkton and North East. The site consists of two parcels situated in a rural area just north of the Elk Neck State Forest. Included as part of the NJF property is the Route 7 Dump site (MD-075) located at the extreme western portion of the property. Past activities at the NJF site include the following: In the early 1900s, the Route 7 Dump site portion of the property was utilized as a clay quarry that supplied a brick manufacturer. During the World War II period, by-products of nearby munitions production as well as scrap rubber from the Bayshore Rubber Plant were disposed of in the former clay quarry. In 1956, Mr. Anthony Fabrizi purchased the property and started the New Jersey Fireworks Company, Inc. and began the manufacture of "Class C" fireworks. Manufacturing occurred on the eastern portions of the property while waste from the production of fireworks was disposed in a pond at the formerly used clay quarry.

In 1976, the company was found to be illegally burning and disposing of waste fireworks, which contained heavy metals, and dumping them in the pond. In 1980, Order C-O-81-076 was issued to the facility by the Department of Health and Mental Hygiene (DHMH) which required NJF to immediately cease and desist from disposing wastes in or near the on-site pond (Route 7 Dump site). On June 19, 1987, Site Complaint SC-O-87-268 was issued to the facility by DHMH in response to the continued open burning of wastes without a permit and the improper accumulation and storage of controlled hazardous substances.

In 1988, NJF was identified by MDE as a hazardous waste generator and subject to requirements for generators set forth in COMAR 26.13. Later that year, a draft Consent Order was issued by MDE to Mr. Fabrizi to ensure the proper handling and

disposal of controlled hazardous substances and solid wastes throughout the facility. However, a final Consent Order was never signed.

After the death of Mr. Fabrizi in January 1991, operations at the facility were scaled down and the manufacture of fireworks ceased by 1993. Operations at the facility currently consist primarily of repackaging imported fireworks.

In May 1999, the Bureau of Alcohol, Tobacco and Firearms (ATF) and MDE personnel from the Emergency Response, Hazardous Waste and State Superfund Divisions inspected the NJF facility. The inspection revealed that large amounts of fireworks and black powder were accumulated and stored in an unsafe manner. Additional burn areas identified during the investigation, which were not part of the Route 7 Chemical Dump, prompted the need for an assessment of the whole property.

In June 1999, the property was transferred from New Jersey Fireworks, Inc. to Sun and Star, LLC.

In April 2000, MDE conducted an PA/SI and collected groundwater, surface water, sediment and soil grab samples to assess potential contamination at the site. The Toxicological Evaluation of the analyses results revealed an unacceptable level of risk to populations in a commercial use scenario due to the ingestion of groundwater or dermal contact with groundwater or surface soil on site. Based on the unacceptable level of risk, MDE has further requirements for NJF.

2.0 Site Description

NJF is located approximately 2.4 miles west of Elkton and 2.5 miles east of the town of North East at 1726 Old Philadelphia Road in Cecil County, Maryland. The site consists of two parcels that comprise approximately 46.5-acres and is situated in a rural area just north of the Elk Neck State Forest. Old Philadelphia Road (Route 7) forms the northern border of the site. The Forest View Village Trailer Park borders the site to the east, Mill Creek and Amtrak railroad tracks form the western and southern border of the site. Another residence located at 1720 Old Philadelphia Road is hydraulically upgradient and lies approximately 250 feet northwest of the NJF office.

The site ranges from approximately 25 feet to 75 feet above Mean Sea Level and gently slopes to the south towards Mill Creek. The eastern portion of the site is open and contains several widely spaced buildings while the western portion of the site is wooded. The roads on the property are unimproved and the property is fenced along the northern, western, and eastern boundaries. The Amtrak railroad and Mill Creek act as a natural barrier to the site along the southern border. Access to the site is restricted by a locked gate. The Maryland grid coordinates are an estimated 646,700 feet north and 1,113,500 feet east. The estimated geographic coordinates are 39° 36' 10" north latitude and 75° 53' 10" west longitude.^{1, 2, 3}

Included as part of the NJF property is the Route 7 Dump site (MD-075) located in the western portion of the property. The Route 7 Dump site consists of a former clay

quarry approximately 2 acres in size that was utilized as an unpermitted disposal area. The Maryland grid coordinates are 646,800 feet north and 1,115,000 feet east. The geographic coordinates are 39° 36' 14" north latitude and 75° 53' 23" west longitude.^{3, 4}

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2.1 Site Use and Ownership

In the early 1900s, the Route 7 Dump site portion of the site was utilized as a clay quarry that supplied a brick manufacturer. During the World War II period, by-products from nearby munitions production, as well as scrap rubber from the Bayshore Rubber Plant were disposed in the former clay quarry.

In 1956, Mr. Anthony Fabrizi purchased the property and began operations of the New Jersey Fireworks Company, Inc. to manufacture "Class C" fireworks. "Class C" fireworks consist of eleven categories of various types of fireworks each with its own limit of total pyrotechnic composition (e.g. roman candles 20 grams, sky rockets 20 grams, firecrackers and salutes 2 grains, etc.). During the height of manufacturing activity, 77 buildings and 17 trailers existed on site. Manufacturing occurred on the eastern portions of the property while waste from the production of fireworks was taken to the quarry area where it was burned and pushed into the former pond on the western side of the property.

In 1983, the Maryland State Highway Administration used the on-site pond to dispose of fill dirt from road construction and completely filled and regraded the former pond.^{1, 5}

The manufacturing of "Class C" fireworks ceased sometime in 1991 or 1992. With the cessation of manufacturing, the storage and production buildings were left abandoned. Raw materials such as black powder, oxidizers, fuels, binders and other components remained in opened and/or damaged containers and left in piles on countertops, trays and scattered about on the floors in the dilapidated buildings and trailers.

On June 30, 1999, both parcels that comprise the NJF site were transferred to Sun and Star, LLC, owned by Mr. Richard Wong. Later that same year, extensive cleanup of the property was initiated. The dilapidated buildings, trailers and hazardous materials were removed from the site and a new office building and an approximate 28,000 square foot warehouse were erected. NJF now only imports, repackages and distributes "Class C" fireworks.

2.2 Permitting, Regulatory Actions and Investigations

According to MDE files, NJF was found to be illegally dumping wastes in 1976. In October 1980, Ecology and Environment, Inc. and DHMH conducted an inspection of the Route 7 Dump site. Reportedly, samples collected from an on-site pond used for illegal dumping revealed some inorganic contamination. No other details were given other than the contamination had likely not migrated off site.^{1, 4}

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On November 6, 1980, DHMH issued NJF Order C-O-81-076. The Order required NJF to immediately cease and desist from disposing wastes in or near the pond (Route 7 Dump site), submit a close out plan for the disposal area, submit applications for appropriate permits and submit an action report.⁴

In February 1982, NJF was issued permit number 73-DP-0333 authorizing discharge of wastewater into a seepage pond located just southeast of a sparkler manufacturing building near an unnamed tributary of Mill Creek.¹

In December 1983, the NUS Corporation conducted a Site Inspection of the Route 7 Dump site (MD-075), at which time samples were collected from on-site surface waters and an adjacent stream. Elevated concentrations of barium (19,300 µg/L) were detected in an on-site pond sample. Trace amounts of cadmium, cobalt and chromium were also detected. No organic priority pollutants were confidently identified in the samples collected. The toxicological evaluation revealed no environmental or human health hazards.⁴

On June 19, 1987, Site Complaint SC-O-87-268 was issued to the facility in response to the continued open burning of hazardous wastes without a permit and improper accumulation and storage of controlled hazardous substances.¹

Sometime in 1988, NJF was identified by the MDE as a hazardous waste generator and was subject to regulations set forth by the Hazardous Waste Enforcement Division. A former wastewater seepage pond near a sparkler manufacturing building was of primary concern, as concentrations of barium in the soil reached 63,000 mg/Kg. Later that year, a draft Consent Order was issued to Mr. Fabrizi to ensure the proper handling and disposal of hazardous and solid waste at the facility. However, a final Consent Order was never signed.¹

In June 1992, the MDE's Site Assessment/Pre-Remedial Division conducted a Level I Site Inspection Prioritization on the Route 7 Dump site. Using existing analytical data, the site was evaluated and recommended for a "No Further Remedial Action Planned" (NFRAP) status. No additional samples were collected at that time. As a result, EPA designated the Route 7 Dump site as NFRAP on September 30, 1992.⁵

In May 1999, the ATF and MDE personnel from the Emergency Response, Hazardous Waste Enforcement and State Superfund Divisions inspected the NJF facility. The inspection revealed that large amounts of fireworks and black powder were accumulated and stored in an unsafe manner. Raw materials such as black powder, oxidizers, fuels, binders and other fireworks components remained in opened or damaged containers and left in piles on countertops, trays and scattered about the floors of dilapidated buildings. Also observed during the inspection were rusted 30-gallon and 55-gallon drums, some of which possessed legible labels indicating that they contained potassium perchlorate. Additionally, several pit-like depressions located in a wooded area that were used for the burning and disposal of old fireworks were noted as remnants of fuses and fireworks were seen around the edges of the pits. Lastly, a waste disposal area was observed on the southwest portion of the property. This waste disposal area

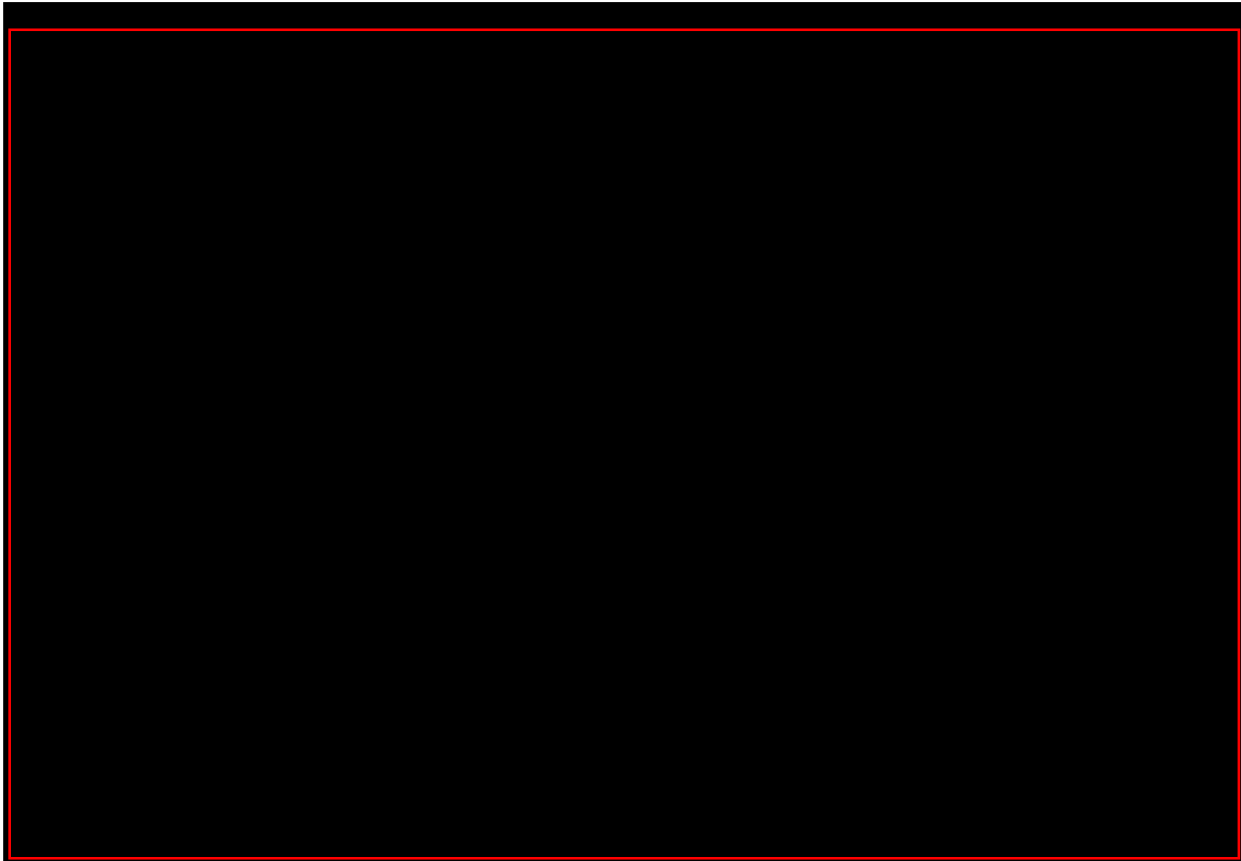
consisted of wooden pallets, drums, aerosol cans, oil containers, auto parts, cinders and other scattered debris, some of which may have contained asbestos.⁵

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2.3 Remedial Actions

As a result of the ATF/MDE inspection in May 1999, extensive cleanup of the site has occurred. Nearly all of the dilapidated buildings have been demolished and removed. All of the abandoned aboveground storage tanks, most of the empty drums, most of the waste pile, and trailers that housed improperly stored hazardous and suspected hazardous materials have been removed with oversight of MDE's Hazardous Waste Enforcement Division. A new office and gravel parking lot have been built and an approximate 28,000 square foot warehouse erected on the southern portion of the property. Inspections by MDE's Hazardous Waste Program personnel continue to occur at the NJF facility on a regular basis.

3.0 ENVIRONMENTAL SETTING



3.2 Surface Waters

Overland flow from the site and surrounding highlands discharges directly into Mill Creek on the western and southern borders of the site or into an unnamed tributary of Mill Creek on the eastern portion of the site. Mill Creek flows eastward approximately 2 miles and empties into Little Elk Creek. Little Elk Creek turns south as it joins Big Elk

Creek in a marshland south of Elkton before eventually discharging into the Elk River and then into the Chesapeake Bay.⁸

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Surface Water Pathway and Approximate Wetland Frontages^{5, 8}

FROM	TO	WETLAND FRONTAGE (MILES)	FLOW RATE (CFS)
Probable Point of Entry Mill Creek	Convergence with Little Elk Creek	2.1	~ 45
Little Elk Creek	Convergence with Big Elk Creek	3.6	300
Big Elk Creek	Convergence with Elk River	3.0	~ 1,200
Elk River	Terminus of 15 mile Pathway	15	N/A

N/A= Not Available

The U.S. Geological Survey classified various wetlands along this surface water pathway. Mill Creek, including the portion onsite, is classified as a Palustrine, Seasonal, Forested wetland until approximately one-half mile downstream to the confluence with Little Elk Creek, where it becomes a mixture of Emergent and Scrub/Shrub wetland. Various palustrine forested and emergent wetlands are found along the banks of Little Elk Creek and Big Elk Creek. Estuarine wetlands are found along the perimeter of the Elk River. Mill Creek is within a 100-year floodplain. Areas along the banks of Mill Creek are within the 500-year floodplain. The site itself is outside of the 500-year floodplain as identified by the Federal Emergency Management Administration.^{8, 9}

MDE has no documentation to establish Mill Creek, in the vicinity of the site, as a fishery.

3.3 Soils

The soils occurring on and around the site are of the Keyport series developed in old Coastal Plain deposits, which range from gravelly, loamy sand to clay. Areas with a mantle of sandy loam, loam, or silty loam are moderately well drained. Otherwise water moves slowly through the subsoil in the Keyport.¹⁰

3.4 Geology

The site lies just east of the Fall Line that separates the Coastal Plain Physiographic Province from the Piedmont Physiographic Province to the west. Beneath the Keyport soils on-site is a thin veneer of surficial Quaternary sedimentary deposits that consist of multicolored pebbly sand, silt, and clay. These deposits dip east to southeast at a low angle, generally less than one degree. The Cretaceous Potomac Group that broadly dips and thickens to the southeast underlies the Quaternary sedimentary deposits. The Cretaceous Potomac Group rests upon crystalline basement rock of the Piedmont.^{4, 5}

The Quaternary sediments consist of tan-gray to orange, medium to coarse-grained silty sand with gravel layers. Well logs in a 3-mile radius of the area indicate

thickness in a range of 10 to 60 feet. The Potomac Group is characterized by large, abrupt variations of discontinuous sand lenses interbedded with lenses of clays, silty clays and gravels of limited areal extent. Like much of the Quaternary deposits, the thickness of the Potomac Group is highly variable, ranging from 18 to 170 feet thick within a 3-mile radius of the site. The Piedmont crystalline basement complex consists of lower Paleozoic and Precambrian igneous and metamorphic rocks. Locally, competent bedrock is reported to occur at depths ranging between 150 and 184 feet.^{4, 5}

3.5 Groundwater

Groundwater flow in the Quaternary deposits is unconfined and reported to be through intergranular openings and the presence of confining layers may alter groundwater conditions such that flow is perched. Local topography is the primary influence on flow direction, which overall directs flow to the south and east. Recharge occurs by precipitation.¹¹

Specific aquifer characteristics of the Potomac Group are reported to be variable and difficult to evaluate. The greatest groundwater flow occurs through the permeable sands and, like the Quaternary deposits, confining layers may alter groundwater conditions such that flow is perched or confined. Groundwater flow direction generally follows the thickening deposits that dip to the southeast. Because the Potomac Group does outcrop in areas along the Fall Line, recharge of the aquifer occurs by precipitation in those areas or, where confined, through the permeable Quaternary deposits.¹¹

The occurrence and movement of groundwater in the crystalline bedrock is reported to be through fractures and intergranular flow where weathering has taken place. Flow is dependent upon the number of fractures, their size and interconnectedness. Recharge takes place through the overlying water bearing units of the Potomac Group and the Quaternary deposits.¹¹

3.6 Meteorology

Cecil County has a humid, continental climate with well-defined seasons. The warmest part of the year is July and the coldest part of the year is January. The average annual temperature is 54° F. The average annual rainfall is 45 inches per year and the annual evaporation is 35 inches per year. The 2-year 24-hour precipitation in Cecil County is 3.0 inches.^{5, 12}

3.7 Nearby Land Use and Population Distribution

The area surrounding NJF consists mainly of rural wooded lots, some of which are occupied by commercial enterprises. The Forest View Mobile Home Park is immediately east of the site, the Elk Neck State Forest is located approximately ¼ mile south. A septic cleaning service is located west of the property and a defunct logging company (previously Keystone Fireworks Company) is located north of the site. Approximately 23,343 people are estimated to live within a four-mile radius of the site, as shown in the following Table.⁷

RING DISTANCE	1990 CENSUS POPULATION	1990 CENSUS POPULATION +15%
0 - ¼ mile	40	46
¼ - ½ mile	117	134
½ - 1 mile	431	496
1 - 2 miles	2,388	2,745
2 - 3 miles	7,187	8,265
3 - 4 miles	8,408	9,667
Total Population	20,561	23,343

4.0 WASTE DESCRIPTION

Wastes disposed of on site include burned class C fireworks, by-products from munitions production, road construction debris, miscellaneous debris and deteriorated drums. Compounds included in the manufacture of class C fireworks and munitions are potassium perchlorate, barium nitrate, copper oxide, alcohol and aluminum. Chlorinated solvents were also used as cleaning agents in the manufacturing process. Miscellaneous debris observed in a waste pile located in the drainage into Mill Creek included wooden pallets, possible asbestos-containing building materials, aerosol cans, oil cans, various auto parts and trash. Deteriorated drums were observed scattered about in the wooded sections of the property. Much of these wastes have been cleaned up and removed from the site.^{1, 4, 5}

5.0 SITE SAMPLING

5.1 MDE CLP Sampling

In preparation for the PA/SI, MDE submitted a sampling plan proposal to EPA Region III in January 2000. EPA gave verbal approval for the plan at the end of February 2000. The PA/SI sampling took place on April 20 and 21, 2000.

MDE sampling was carried out in accordance with the EPA CLP Routine Analytic Services (RAS), as case number 27981. The samples were analyzed for a full scan of all priority pollutants, which include volatile organics (VOCs), semivolatile organics (SVOCs), pesticides and polychlorinated biphenyls (PCBs), total metals, and cyanide. The following samples were collected at depths of at least one foot and analyzed according to EPA Method 300.0 for the presence of perchlorates: GW-4, GW-5, SW-3, SW-3D, SED-3, S-4, S-6, S-8, and S-10. The samples were collected at depths of at least one foot due to the degradation effects of sunlight on perchlorate compounds. There were no positive results above the reporting limit in any of these samples.

The MDE samples were collected in four sample matrices: one organic aqueous, one organic solid, one inorganic aqueous, and one inorganic solid. Each matrix included collection of a field duplicate sample and an additional matrix spike volume. In addition, each aqueous matrix was provided with a field blank, which consisted of deionized water placed into appropriate sample containers in the field on the day of the sample collection. The field blank aliquots were preserved as appropriate for the required analysis.

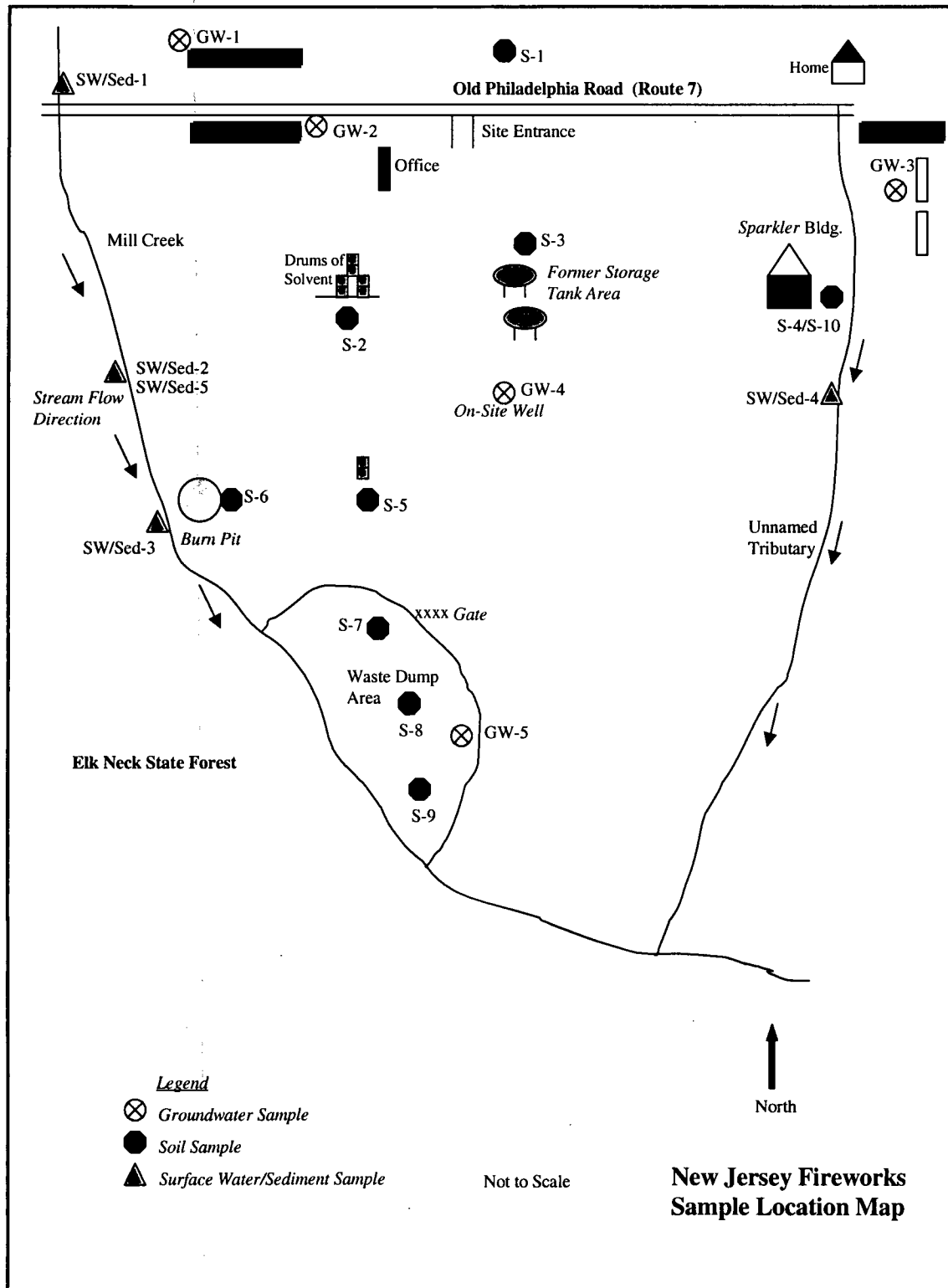
The sample collection log is shown in **Table 1**, the sampling locations are depicted in Figure 1 and the results are tabulated in section 5.2.

TABLE 1 Sampling Log

Sample	Sample Type	Sample Location	Rationale
GW-1	Aqueous/spike	Residential well at [REDACTED]	Background.
GW-2	Aqueous	Residential well at [REDACTED]	Characterize off-site groundwater.
GW-3	Aqueous	[REDACTED]	Characterize off-site groundwater.
GW-4	Aqueous/perchlorate scan	On-site well.	Characterize on-site groundwater.
GW-5	Aqueous/perchlorate scan	On-site geoprobe location near the waste pile.	Characterize on-site groundwater.
SW-1	Aqueous	Mill Creek upstream from site.	Background.
SW-2	Aqueous	Mill Creek adjacent to waste pile.	Determine if waste has migrated off-site.
SW-3/SW-3D	Aqueous/perchlorate duplicate (aqueous)	On-site pond or downstream sample.	Determine if waste has migrated off-site.
SW-4	Aqueous	Unnamed tributary on the eastern side of the site.	Determine if waste has migrated to tributary.
SW-5	Aqueous	See SW-4.	Duplicate of SW-4
Sed-1	Sediment	See SW-1.	Background.
Sed-2	Sediment	See SW-2.	Determine if waste has migrated off-site.
Sed-3	Sediment/perchlorate duplicate (solid)	See SW-3.	Determine if waste has migrated off-site.
Sed-4	Sediment	See SW-4.	Determine if waste has migrated to tributary.
S-1	Soil	North of site, across Route 7 from the site entrance.	Background.
S-2	Soil	Route 7 Dump site.	Characterize waste source.
S-3	Soil/spike	Former AST Area.	Characterize waste source.
S-4	Soil/perchlorate scan	Sparkler Building (sample to be collected at approximately 5 foot depth).	Characterize waste source of former lagoon area.
S-5	Soil	Fireworks Manufacturing. Bldg.	Characterize waste source.
S-6	Soil/perchlorate scan	Burn Pit Area.	Characterize waste source.
S-7	Soil	Waste Pile Area.	Characterize waste source.
S-8	Soil/perchlorate scan	Waste Pile Area.	Characterize waste source.
S-9	Soil	Waste Pile Area.	Characterize waste source.
S-10	Soil/perchlorate scan	Sparkler Building (sample to be collected at approximately 5 foot depth).	Duplicate sample of S-4.

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Figure 1: Site Sketch of the Sampling Locations



6.0 SAMPLING RESULTS

Inorganic Analytes in Groundwater and Surface Water Samples ($\mu\text{g/L}$):

ANALYTE	GW-1 Res. well	GW-2 Res. well	GW-3 Res. well	GW-4	GW-5	SW-1 background	SW-2	SW-3	SW-4	SW-5 Dup SW-4
ALUMINUM		[65]	[30.5] L	[39] L	94200	675	471	231	280	302
ANTIMONY					[5.7]					
ARSENIC					267			[3.4]		
BARIUM	[20.7]	[10.3]	[14.4]	[13.1]	714	[34.7]	[49.8]	[57.4]	1590	1660 K
BERYLLIUM			[1.1]		27.5					
CALCIUM	[1930]B	[943]B	[1160]B	[1000]B	6930	5560	5050	[3700]	14500	14600
CHROMIUM	[5.3]		[2.3]		1450	[4.4]				
COBALT	[6.9]	[5.7]	[10.7]	[15.8]	194	[3.9]	[9.1]	[9.4]	[2.1]	
COPPER	258	149	41.7	26.3	424	[2.1]	[2.2]		[4.5]	[4.9]
IRON		[39.4]	179	[53.1]	575000 J	1440	1220	10700	2210	2390
LEAD	7.5	4.6 L	11.2	[2.0] L	122			[2.3] L	[2.7] L	[2.1] L
MAGNESIUM	[964]	[625]	[553]	[518]	13300	[2360]	[2110]	[1620]	[4230]	[4000]
MANGANESE	17.5	[8.4]	[12.9]	[11.5]	1620	51.5	132	276	148	152
MERCURY	[0.12]B	[0.12]B			0.57 B	[0.17]B		[0.12]B	[0.14]B	[0.1]B
NICKEL	[13.3]	[10.7]	[23.4]	[26.1]	97.7	[6.5]	[7.9]	[5]	[5.3]	[5.5]
POTASSIUM	[477]B	[359]B	[491]B	[495]B	7800	[1620]B	[1530]B	[1150]B	12300	14000
SELENIUM					10.5					
SILVER										[5]B
SODIUM	6860 J	[4360] J	[3600] J	[3790] J	39400 J	11400 J	13400 J	7620 J	21100 J	21500 J
VANADIUM					1480	[2.7]				
ZINC	29.3 K	[13.6]B	57.8	24.8 K	456	25.0 K	28.2 K	27.1 K	[17.8]B	[17.1]B
CYANIDE		[1.1]	[1.7]		[1.6]	[1.3]	[1.0]	[1.0]	[2.2]	[1.7]

Qualifiers: J = analyte present, reported value may not be accurate or precise.

B = not detected substantially above the level reported in laboratory or field blanks.

[] = analyte present, as values approach the instrument detection limit the quantitation may not be accurate.

K = analyte present, reported value may be biased high, the actual value is expected to be lower.

L = analyte present, reported value may be biased low, the actual value is expected to be higher.

Highlighted values in red exceed Maximum Contaminant Levels (MCLs).¹³

Inorganic Analytes in Filtered Groundwater and Surface Water Samples (µg/L):

Analyte	GW-4DM	GW-5DM	SW-1DM background	SW-2DM	SW-3DM	SW-4DM	SW-5DM Dup. SW-4
ALUMINUM		[76.8]	[193]	[189]	[100]	213	[187]
ANTIMONY						[3.8]	[4.2]
BARIUM	[12.5]	[25.5]	[34.1]	[46.3]	[53.1]	1560	1640
CALCIUM	[1030]	[2480]	6100	[4940]	[3790]	14600	14900
COBALT	[16.4]	[27.3]	[3.5]	[8.9]	[10]	[3]	[3]
COPPER	[23.3]		[2.3]B	[1.6]B	[1.6]B	[4.1]B	[5.3]B
IRON	[33.7]B	1200	615	724	8960	1880	1870
LEAD							[2.0] L
MAGNESIUM	[517]	[3430]	[2030]	[1930]	[1640]	[4070]	[4240]
MANGANESE	[11.4]	410	53.7	129	254	144	122
MERCURY	[0.1]B			0.46 B	[0.14]B	[0.11]B	[0.11]B
NICKEL	[25.8]	[7.7]	[6.0]	[7.5]	[4.8]	[5.5]	[6.1]
POTASSIUM	[467]	[298]	[1500]	[1440]	[1090]	12700	13400
SODIUM	[3700]	38900	11900	12600	7470	21300	22000
ZINC	26.7	[6.3]B	[18.3]	28	26.2	[18.4]	[16.7]

Qualifiers: J = analyte present, reported value may not be accurate or precise.

B = not detected substantially above the level reported in laboratory or field blanks.

[] = analyte present, as values approach the instrument detection limit the quantitation may not be accurate.

L = analyte present, the reported value is biased low, the actual value is expected to be higher.

Inorganic Analytes in Soil Samples (mg/Kg):

Analyte	S-1 background	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
ALUMINUM	2400	1730	1860	6310	117000	7930	5800	5670	6780	9790
ANTIMONY					71.6		[1.5]	[4.3]	[4.6]	
ARSENIC	2.5 B	2.3 B	4.0 K	[1.8]B	5.3	3.1	4.8	13.1	4.9	4.3
BARIUM	[36]	[10.4]	[10.3]	2130	5900	[24.4]	49.7	1240	2080	3350
BERYLLIUM				[0.25]		[0.29]	1.5	[0.37]		[0.59]
CALCIUM	[659]	[76.5]	[138]	[151]	[206]	[76.3]	[213]	1460	[384]	[221]
CHROMIUM	9.4	10.7	25.5	20.2	12.4	29.8	44.5	21.5	139	23.5
COBALT			[4.3]	[7.3]		[2.2]	[5.3]	[2.9]	[2.2]	[2]
COPPER	16.6	5.3	12.2	5.9	50.9	11.9	26.9	23.9	58.3	[3.4]
IRON	5380	4460	15500	12900	14700	13700	61500	23000	65500	10400
LEAD	63.1 J	2.7 J	1.7 J	6.1 J	28.3 J	5.1 J	5.5 J	117 J	14.4 J	8.9 J
MAGNESIUM	[362]	[103]	[78]	[327]	[159]	[952]	1350	[497]	[183]	[554]
MANGANESE	293	19.4	48	272	52.9	41.2	34.4	84.6	300	102
MERCURY	[0.09] B		[0.05]B	[0.12]B	[0.08]B	0.15 B		0.14 B	[0.05]B	[0.10] B
NICKEL	[4.7]	[0.97]	[1.8]	[2.7]	18.2	[5.1]	12.6	15.2	60.9	[6]
POTASSIUM	[168]B	[58.7]B	[72]B	[324]B	[177]B	[358]B	[294]B	[232]B	[297]B	[409]B
SELENIUM							2.5	1.6 L	2.1 L	
SILVER							[0.56]		[0.34]	
SODIUM	[458]K	[258]K	[316]K	[326]K	[403]K	[314]K	[566]K	[473]K	[341]K	[420]K
THALLIUM	[0.84]	[1.1]	2.7	[1.8]	[2.1]	[2.2]	8.2	3.2	9.2	[1.9]
VANADIUM	12.1	[6.7]	12.9	20.8	18.3	40.8	47.5	56.3	18	42.6
ZINC	33.9	4.4	11.2	10.4	47.1	15.6	32.2	102	38.8	17.9
CYANIDE	[0.34] B	[0.06] B		[0.08] B	[0.24] B	[0.11] B		[0.19 B	[0.36] B	[0.17] B

Qualifiers: J = analyte present, reported value may not be accurate or precise.

B = not detected substantially above the level reported in laboratory or field blanks.

[] = analyte present, as values approach the instrument detection limit the quantitation may not be accurate.

K = analyte present, reported value may be biased high., actual value is expected to be lower.

L = analyte present, reported value may be biased low, actual value is expected to be higher.

Inorganic Analytes in Sediment Samples (mg/Kg):

Analyte	SED-1 background	SED-2	SED-3	SED-4
ALUMINUM	517	1470	7970	3600
ANTIMONY			[1.2]	[1.7]
ARSENIC	[0.97]B	[1.6]B	6.8	3.5
BARIUM	[3.8]	[29.9]	81.2	294
BERYLLIUM		[0.51]	[1.5]	[0.35]
CALCIUM	[145]	[529]	[742]	[325]
CHROMIUM	6.1	9.6	37.7	22.1
COBALT		[3.6]	22.7	[2.8]
COPPER	[2]	16	23.5	8.8
IRON	2260	4430	21800	15300
LEAD	2.9 J	13.9 J	34.3 J	10.5 J
MAGNESIUM	2000	[267]	[1190]	[325]
MANGANESE	14.1	39.1	94.5	205
MERCURY		[0.7]B	0.18 B	[0.06]B
NICKEL	20.5	[5.1]	26.9	[3.7]
POTASSIUM	[68.9]B	[80.5]B	[373]B	[166]B
SODIUM	[358]K	[406]K	[588]K	[349]K
THALLIUM	[0.85]	[0.83]	[3.3]	[2.2]
VANADIUM	[6.3]	[10]	37.7	29.9
ZINC	8.1	26.7	120	22.7
CYANIDE	[0.09] B	[0.14] B	[0.48] B	[0.11] B

Qualifiers: J = analyte present, reported value may not be accurate or precise.

B = not detected substantially above the level reported in laboratory or field blanks.

[] = analyte present, as values approach the instrument detection limit the quantitation may not be accurate.

K = analyte present, reported value may be biased high., actual value is expected to be lower.

Highlighted values exceed National Oceanic and Atmospheric Administration Threshold Effects Limits for Freshwater Sediments.¹⁴

Pesticide and PCB results:

Analyte	S-1 ($\mu\text{g/Kg}$) background	S-8 ($\mu\text{g/Kg}$)	SW-4 ($\mu\text{g/L}$)
4,4'-DDT	4.1 J	7.6 J	
4,4'-DDE	3.8 J		
METHOXYCHLOR			0.86 J

Qualifiers: J = analyte present, reported value may not be accurate or precise.

VOC results: (VOCs were not detected in aqueous samples)

Analyte (µg/Kg)	S-1 background	S-4	S-5	S-9	S-10
1,1,1-TRICHLOROETHANE		16			
1,1-DICHLOROETHANE		3 J			
1,1-DICHLOROETHENE		8 J			
2-BUTANONE				14 J	17 J
ACETONE			37J		
TETRACHLOROETHENE		9 J			
TOLUENE	4 J				

Qualifiers: J = analyte present, reported value may not be accurate or precise.

SVOC results (SVOCs were not detected in aqueous samples, except field blank):

Analyte (µg/Kg)	FB-1	S-1 background	S-3	S-4	S-8	S-9	SED-2
2-METHYLNAPHTHALENE					650 J	120 J	
ACETOPHENONE					90 J		
BENZO[A]ANTHRACENE		150 J					
BENZO[A]PYRENE		190 J			160 J	90 J	
BENZO[B]FLUORANTHENE		150 J			96 J	120 J	
BENZO[G,H,I]PERYLENE		110 J			94 J	94 J	
BENZO[K]FLUORANTHENE		170 J				100 J	
BIS(2-ETHYLHEXYL)PHTHALATE				130 J			220 J
CHRYSENE		260 J			120 J	120 J	
DIBENZOFURAN					230 J		
DIBUTYLPHTHALATE		540 B	92 B		110 J		
DIETHYLPHTHALATE	5 J						
FLUORANTHENE		250 J				130 J	
INDENO[1,2,3-CD]PYRENE		120 J			88 J	100 J	
N-NITROSODIPHENYLAMINE					92 J		
N-NITROSODIPROPYLAMINE					140 J		
NAPHTHALENE					550	110 J	
PHENANTHRENE		160 J			430	120 J	
PYRENE		380 J			90 J	120 J	

Qualifiers: J = analyte present, reported value may not be accurate or precise.

B = not detected substantially above the level reported in laboratory or field blanks.

6.1 Groundwater Sampling Results

MDE collected a total of five groundwater grab samples; one each from two nearby residential wells, a nearby community well, an on-site well, and one geoprobe boring near a former waste pile. A filtered grab sample was collected from each groundwater location. Samples collected from locations GW-4 and GW-5 were also analyzed for perchlorates. Although analysis failed to detect perchlorates in the groundwater samples,

the technical holding time of twenty-eight days was exceeded by five and six days. The data validation for this analysis considered the holding time expiration a minor problem.¹³ The depths at which the residential wells are screened is unknown.

Groundwater sample GW-2, collected from a residential well at [REDACTED] d, utilizes a filtration system due to strong ferric odor and taste of the groundwater. The residential, community and on-site wells were purged for at least ten minutes prior to sample collection. The analyses results were screened against Maryland MCLs. Only sample GW-5, collected from the water table beneath the waste pile, contained contamination above MCL screening values. The inorganic contaminants arsenic (267 µg/L), beryllium (27.5 µg/L), chromium (1450 µg/L) and lead (122 µg/L) were detected above MCLs.

Chemical analyses of groundwater samples collected onsite may reveal a release of contaminants, due to previous fireworks manufacturing, to groundwater beneath the site. All of the inorganic analytes, with the exception of copper, were detected at levels three times greater than background. Many of the detected inorganic analytes may be associated with fireworks manufacturing known to have occurred onsite.

The toxicological evaluation revealed an unacceptable risk to commercial use populations that may ingest or have dermal contact with the groundwater beneath the site. Detailed discussion is outlined in the toxicological evaluation. Because of the unacceptable risk revealed in the toxicological evaluation, MDE has further requirements regarding the groundwater conditions at this site.

6.2 Surface Water/Sediment Sampling

MDE collected five surface water and four sediment grab samples from Mill Creek and one from an unnamed tributary flowing into Mill Creek. A filtered surface water sample was collected from each of the surface water sampling locations. The sediment sample locations were coincident with the surface water sampling locations. Additionally, grab samples SW-3 and SED-3 were collected in amber jars and analyzed for perchlorates. Although analysis failed to detect perchlorates in the surface water and sediment samples, the technical holding time of twenty-eight days was exceeded by five and six days. The data validation for this analysis considered the holding time expiration a minor problem.¹³ The chemicals detected in the surface water samples were screened against Toxic Substance Criteria for Ambient Surface Water (Table 1) in the Code of Maryland Regulations, Volume XXIV, Subtitle 26.08.02.03-2.¹⁴ No chemicals detected in the surface water samples exceeded benchmark levels. However, arsenic, barium, iron, manganese and silver were detected at levels three times greater than background, which may reveal a release of contamination to the surface waters onsite due to past manufacturing practices.

Analytes detected in the sediment samples were screened against NOAA guidelines for freshwater sediment.¹⁵ Arsenic (6.8 mg/Kg) and chromium (37.7 mg/Kg) were detected in SED-3 that exceed NOAA Threshold Effects Limits for freshwater sediment. Additionally, the inorganic contaminants aluminum, arsenic, barium, chromium, cobalt, copper, lead, manganese, vanadium and zinc were detected at levels

three times greater than background, which may reveal a release of contaminants due to past manufacturing practices. The toxicological evaluation of the contaminants detected in the surface water and sediment samples did not reveal unacceptable risk to human health.

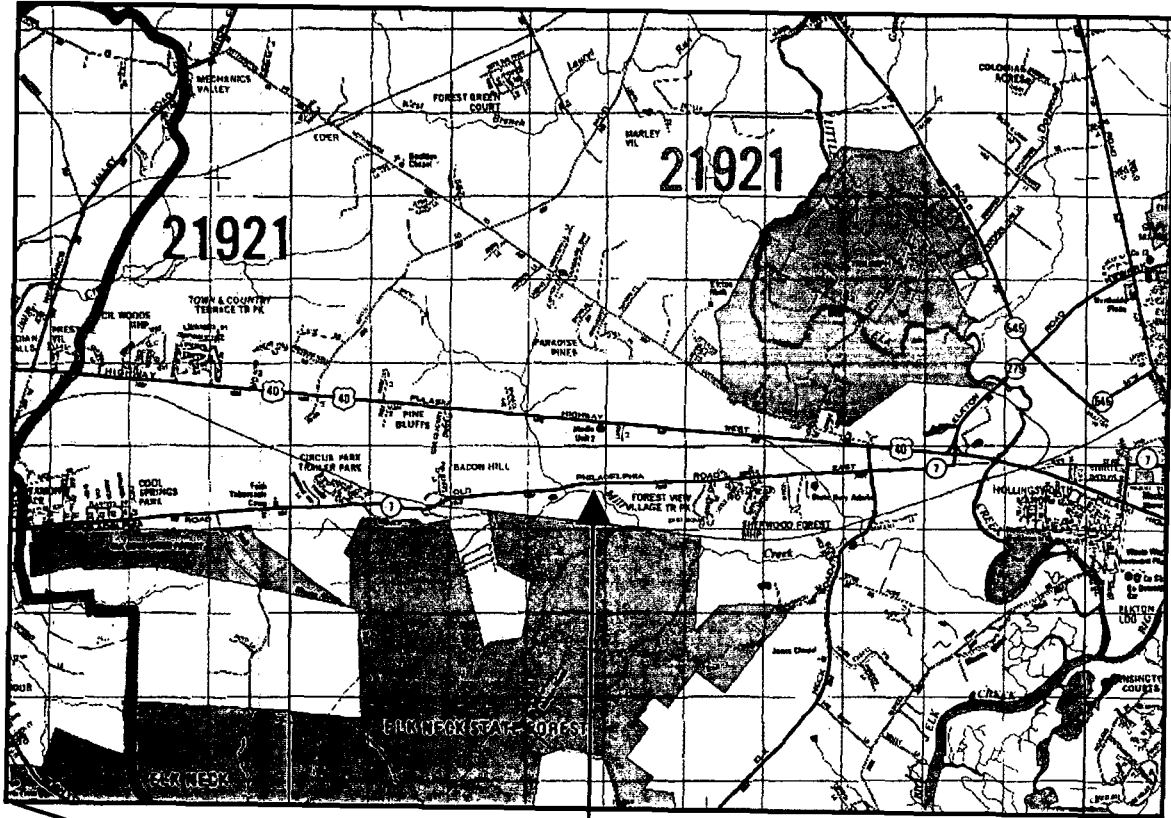
6.3 Soil Sampling

MDE collected ten soil grab samples that were screened against EPA Risk-Based Concentration Levels (RBCs).¹⁶ Additionally, samples S-4, S-6, S-8, and S-10 were analyzed for perchlorates and were collected in amber jars at depths of at least one foot. Although analysis failed to detect perchlorates in the soil samples, the technical holding time of twenty-eight days was exceeded by five and six days. The data validation for this analysis considered the holding time expiration a minor problem.¹³ The low levels of inorganic and organic contaminants detected in the soil samples did not exceed benchmark values. However, aluminum, antimony, arsenic, barium, chromium, cobalt, copper, iron, nickel, thallium, vanadium and zinc were detected at levels greater than three times the background levels.

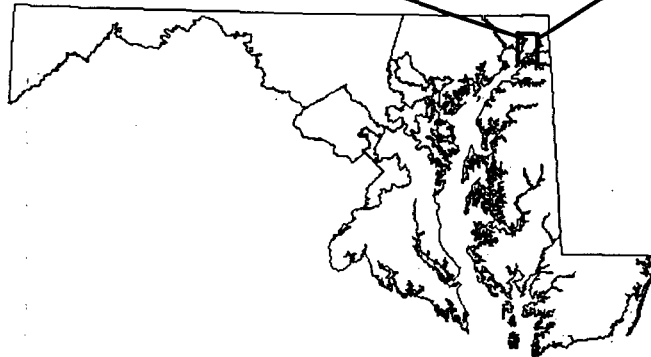
The toxicological evaluation revealed an unacceptable risk to human health under a commercial use scenario due to the potential additive effects of the contaminants detected in the soil samples. A detailed explanation of the inorganic and organic compounds detected in the on-site soil samples is outlined in the toxicological section of the report.

ORIGINAL
(Red)

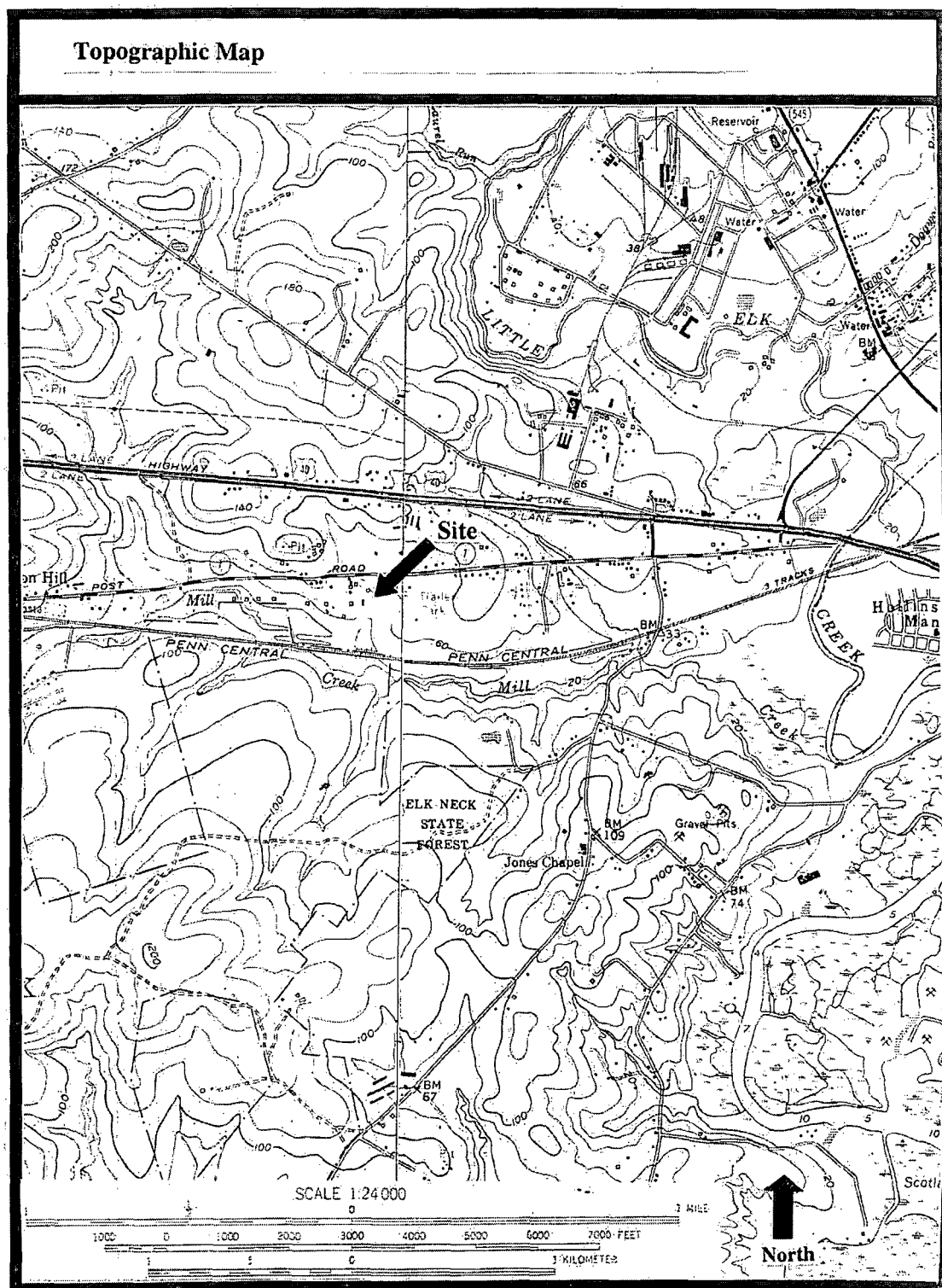
7.0 MAPS
7.1 Regional Map



New Jersey Fireworks site



7.2 Topographic Map¹⁷



New Jersey Fireworks

8.0 REFERENCES

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9.0 TOXICOLOGICAL EVALUATION

Summary

This toxicological evaluation examines the human health risks associated with the New Jersey Fireworks site located at 1726 Old Philadelphia Road, Elkton, Maryland. This site was evaluated for child intermittent visitor (1-6 years), youth intermittent visitor (6-17), adult worker and construction worker under a commercial future use scenario. This toxicological evaluation evaluates risks to commercial use populations only. Non-commercial use scenarios are expected to have higher levels of risk and must be evaluated should the designated use of this property change from commercial to non-commercial. The United States Environmental Protection Agency (USEPA) has recommended default exposure parameters that were used to estimate cumulative risk from all chemicals (1, 2, and 3). USEPA recognizes as an acceptable Hazard Index (HI) values less than or equal to 1 (noncarcinogenic chemicals) and excess lifetime cancer risk (CR) less than or equal to 10^{-6} to 10^{-4} . Risks to ecological receptors were evaluated by comparing groundwater and surface water contaminant concentrations to ambient surface water quality criteria and sediment contaminant concentrations to National Oceanic and Atmospheric Administration (NOAA) Effects Range Median (ERM) values. Based on these exposures, estimated risks at the site were compared to USEPA recommended levels, and the following conclusions were reached:

**Summary table of Hazard Indices (HI) values and Cancer Risk (CR) values
for each commercial population**

<i>Noncarcinogenic Endpoints</i>			
Population	Pathway	Hazard Index	Risk Drivers
Child visitor	Ingestion – surface soil	2	Potential additive effects
Construction worker	Ingestion – surface soil	2	Potential additive effects
Child visitor	Ingestion – groundwater	44	Aluminum, arsenic, chromium, manganese, and vanadium
Youth visitor	Ingestion – groundwater	33	Aluminum, arsenic, chromium, and vanadium
Construction worker	Ingestion – groundwater	53	Aluminum, arsenic, chromium, manganese, and vanadium
Adult worker	Ingestion – groundwater	18	Arsenic, chromium, and vanadium
Child visitor	Dermal-groundwater	3	Chromium
Youth visitor	Dermal-groundwater	2	Chromium
Construction worker	Dermal-groundwater	9	Chromium
Adult worker	Dermal-groundwater	17	Chromium
<i>Carcinogenic Endpoints</i>			
Population	Pathway	Cancer Risk	Risk Drivers
Child visitor	Ingestion – groundwater	8×10^{-4}	Arsenic
Youth visitor	Ingestion – groundwater	1×10^{-3}	Arsenic
Construction worker	Ingestion – groundwater	2×10^{-4}	Arsenic
Adult worker	Ingestion – groundwater	1×10^{-3}	Arsenic
Child visitor	Dermal-groundwater	1×10^{-3}	Potential additive effects*
Youth visitor	Dermal-groundwater	2×10^{-3}	Potential additive effects*
Construction worker	Dermal-groundwater	5×10^{-4}	Potential additive effects*
Adult worker	Dermal-groundwater	3×10^{-2}	Potential additive effects*

*Potential additive effects were based on non-detected compounds only (see text).

Site Description

The New Jersey Fireworks site is approximately 46.5 acres total area located at 1726 Old Philadelphia Road, Elkton, Maryland. The site includes the Route 7 dump (MD-075) which is located on the western portion of the site. The Route 7 dump site was an unpermitted disposal area approximately 2 acres in size. This toxicological evaluation will examine the risks to human health or the environment associated with historical site activities.

The western portion of the site was used as a clay quarry during the early 1900's. Excavated clay from the quarry was supplied to a brick manufacturer. During World War II the former clay quarry was used as a dump (Route 7 Dump, MD-075) for the by-products of munitions productions and for scrap rubber from the Bayshore Rubber plant. The property was sold to the New Jersey Fireworks Company in 1956. The New Jersey Fireworks Company manufactured "Class C" fireworks on the site up until approximately 1991 or 1992. The types of fireworks manufactured at the site included sparklers and black powder explosives. Wastes from the fireworks production processes were disposed of in a pond located on the former clay quarry. In 1983, the Maryland State Highway Administration also used the pond for the disposal of fill dirt from road construction. In 1980, the Department issued Order C-O-81-076 that required the New Jersey fireworks Company to cease and desist from dumping wastes in or around the pond. Plans for closing out the dump site, applications for all appropriate permits and a corrective action report were required by the order. The property is currently used to repackaged imported fireworks for distribution; no fireworks manufacturing currently occurs onsite.

Several depressions, presumably burn pits, exist in a wooded area on the site and were evidently used to dispose of old fireworks. There are also a number of 30 and 50 gallon drums scattered throughout the site; some drums are labeled as containing potassium perchlorate. The southern portion of the site contains a disposal area consisting of wooden pallets, drums, aerosol cans, oil containers, auto parts, cinders, and other assorted debris (some of the debris consisted of asbestos like material).

Drinking water for the population in the immediate vicinity of the site is provided by private wells. Approximately 50 private wells (serving approximately 130 people) are in use within ½ mile of the property. On-site surface water runoff flows into Mill Creek located on the western and southern borders of the site or into the unnamed tributary of Mill Creek located on the eastern portion of the site.

1.0 Method

In evaluating risk to human health, maximum concentrations of all chemicals detected in surface soil (all soil data were assumed to be surface soil as no sampling depth information were provided), sediment, groundwater and surface water were compared to medium-specific screening levels (USEPA Region III Risk Based Concentration values). Chemicals that exceeded human health Risk Based Concentration (RBC) values were then evaluated quantitatively. Relevant toxicological data and RBC values from surrogate compounds (structurally similar analogues) were used for some of the

chemicals with no corresponding RBC value. Groundwater data were collected from groundwater monitoring wells on or in the vicinity of the site and surface water data were collected from locations in Mill Creek and an unnamed tributary of Mill Creek. The evaluation of groundwater was performed as if the water were being used as drinking water. Surface soil and sediment samples were collected from locations on site and in the vicinity of the site.

1.1 Human Health

Maximum concentrations of all chemicals detected in soils and sediments (dry weight values) were compared to the USEPA Region III Risk Based Concentrations (RBC) for residential soil (4). Comparison of dry weight analytical values to the RBCs is recognized as a conservative measure but provides consistency in risk assessments across sites (with variable soil moisture content) and sampling time. Groundwater and surface water maximum concentrations were compared to the USEPA Region III Risk Based Concentrations (RBCs) for tap water. Prior to comparison with each chemical concentration, noncarcinogenic RBCs were multiplied by 0.1, in order to account for any additivity of systemic effects. Carcinogenic RBC values were not adjusted and represent a target risk level of 10^{-6} . Carcinogenic and noncarcinogenic risk levels for all contaminants that exceeded their respective RBC screening level were evaluated quantitatively. The quantitative evaluation was based on expected future use and development scenarios and includes populations typically expected to frequent the site based on this proposed future use.

The future land use at the site was assumed to be commercial, therefore, the commercial exposure scenario was used to evaluate risk at the site. The contaminants identified at the site at concentrations that exceeded residential RBCs were further evaluated with regard to risk to relevant populations under the following scenarios (1, 2, 3, and 7):

Commercial Development:

Adult Worker: 70 kg body weight, 3280 cm² skin surface area (soil), 5670 cm² skin surface area (groundwater), 0.05 skin adherence factor, 250 days per year exposure for soil ingestion, 50 mg soil ingested per day, 0.833 m³/hour inhalation rate, 8 hour exposure time (soil and groundwater), 25 year exposure duration, 70 year lifetime.

Construction Worker: 70 kg body weight, 3280 cm² skin surface area (soil), 5670 cm² skin surface area (groundwater), 0.05 skin adherence factor, 250 days per year exposure for soil ingestion, 480 mg soil ingested per day, 1.5 m³/hour inhalation rate, 4 hour exposure time (groundwater), 8 hour exposure time (soil), 1 year exposure duration, 70 year lifetime.

Youth Intermittent Visitor (6 - 17 years): 40 kg body weight, 4320 cm² skin surface area (soil), 13100 cm² skin surface area (groundwater), 0.02 skin adherence factor, 132 days per year exposure for soil ingestion, 100 mg soil ingested per day, 0.56 m³/hour inhalation rate, 4 hour exposure time (soil ingestion), 0.5 hour exposure time (groundwater dermal contact), 12 year exposure duration, 70 year lifetime.

Child Intermittent Visitor (1 - 6 years): 15 kg body weight, 2350 cm² skin surface area (soil), 6560 cm² skin surface area (groundwater), 0.06 skin adherence factor, 132 days per year exposure for soil ingestion, 200 mg soil ingested per day, 0.32 m³/hour inhalation rate, 4 hour exposure time (soil ingestion), 0.5 hour exposure time (groundwater dermal contact), 6 year exposure duration, 70 year lifetime.

Youth Swimmer (6 - 17 years): 40 kg body weight, 12 events per year, 50 ml water ingested per event, 1 hour exposure time per event, 12 year exposure duration, 70 year lifetime.

Child Swimmer (1 - 6 years): 15 kg body weight, 12 events per year, 50 ml water ingested per event, 1 hour exposure time per event, 6 year exposure duration, 70 year lifetime.

2.0 Human Health Evaluation

Soil, sediment, groundwater and surface water samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals. Chemicals that were detected on site were compared to medium-specific screening levels (USEPA Region III RBC values). Chemicals that were not detected at the site and exceeded RBC values (at an assumed concentration of one half the detection level) were carried through the quantitative risk assessment but were not included in the summation of noncarcinogenic hazard quotients and carcinogenic cancer risk values if their inclusion results in an exceedance of acceptable risk levels. Chemicals detected at the site that exceeded human health RBC values were evaluated quantitatively using the maximum detected concentration as the site-wide average concentration. No RBC values were available for 4-bromophenyl phenyl ether, 4-chloro-3-methylphenol, 4-chlorophenyl phenyl ether, bis(2-chloroethoxy)methane and cyclohexane, however, none of these chemicals were detected in any medium on site. Based upon historical site operations and the non-detection of these chemicals, they were not included in the quantitative risk estimates.

The USEPA has issued a directive for lead that recommends a soil screening level of 400 mg/kg for residential scenarios at RCRA facilities and CERCLA sites for lead; the 400 mg/kg soil screening level was used in this evaluation (5). Magnesium, calcium, potassium, iron and sodium are essential nutrients that were detected on site and are toxic only at very high concentrations. These compounds are found naturally in soils in this geographic region, therefore, they are not included in the quantitative risk estimates.

2.1 Soil

The chemicals detected in surface soils that exceeded the residential soil RBCs (i.e. failed the initial screening process, see Attachment A) were evaluated quantitatively. Soil exposures were evaluated via the ingestion, inhalation and dermal contact pathways. Reference dose (RfD) and cancer slope factor (CSF) values were obtained from USEPA Region III and IRIS (4, 6).

2.2 Sediment

The chemicals detected in sediment that exceeded the residential soil RBCs (i.e. failed the initial screening process) were evaluated quantitatively (Attachment A). Sediment exposures were evaluated via the ingestion, inhalation and dermal contact pathways. Sediments were conservatively evaluated using surface soil exposure scenarios. Reference dose (RfD) and cancer slope factor (CSF) values were obtained from USEPA Region III and IRIS (4, 6). Additionally, for comparative purposes only, sediment contaminant concentrations were compared to effects range-median (ERM) guidelines (8).

2.3 Groundwater

Groundwater samples from the site were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals. Contaminants that were detected above their respective RBC screening level (Attachment A) were evaluated quantitatively for risk. Groundwater exposures were evaluated via the ingestion and dermal contact pathways. Estimates of noncarcinogenic and carcinogenic risks from dermal contact were calculated when sufficient data (permeability constants (10), oral absorption efficiencies and dermal absorption factors (11)) were available. Organic and inorganic contaminants detected in groundwater were also compared to their corresponding MCL (Maximum Contaminant Level). Additionally, groundwater contaminant concentrations were compared to Maryland's ambient water quality standards (AWQS) and USEPA's recommended ambient water quality criteria (AWQC) for the protection of aquatic life and human health.

2.4 Surface Water

Surface water samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals. Contaminants that were detected above their respective RBC screening level (Attachment A) were evaluated quantitatively for risk. Surface water exposures were evaluated via the incidental ingestion while swimming and dermal contact pathways. Maximum detected surface water concentrations were compared to Maryland's ambient water quality standards (AWQS) and USEPA's recommended ambient water quality criteria (AWQC) for the protection of aquatic life and human health.

3.0 Conclusion

3.1 Soil

The estimated noncarcinogenic risk for the construction worker and child visitor populations exceeded USEPA recommended levels of risk (Table 1) for the incidental ingestion of surface soil contaminants. No single noncarcinogenic risk driver for the construction worker or child visitor populations was identified; unacceptable risk levels were due to potential additive effects. Estimated risks from the incidental ingestion of noncarcinogenic surface soil contaminants were within USEPA recommended levels for the adult worker and youth visitor populations. Perchlorate was not detected in any soil sample collected from the site (10 ug/Kg detection limit). Noncarcinogenic risks

associated with perchlorate ingestion from soil were calculated using a provisional reference dose proposed by the USEPA (9) (Table 1). Perchlorate concentrations in soil at a concentration equal to the detection levels obtained for this site are not expected to result in adverse health effects for any commercial population. See Attachment B for additional information regarding perchlorate toxicity. The estimated carcinogenic risks, for all commercial populations, from the ingestion of surface soils were within the USEPA recommended levels (Table 2).

The estimated noncarcinogenic and carcinogenic risk levels from the inhalation of volatiles and fugitive dust from surface soils were within acceptable levels as recommended by USEPA (Tables 3 and 4) for all commercial populations. Dermal exposure to noncarcinogenic and carcinogenic surface soil contaminants were within acceptable levels as recommended by USEPA (Tables 5 and 6) for all commercial populations.

No RBC values for lead are available; however, the maximum concentration of lead detected in surface soil was 117 mg/kg (range = 1.7 to 117 mg/kg), which was below the 400 mg/kg residential soil screening value. Based on the available data, the concentration of lead in surface soil is unlikely to pose a threat to human health and the environment.

3.2 Sediment

The estimated noncarcinogenic and carcinogenic risks for all commercial populations from the ingestion of sediments were within the USEPA recommended levels of risk (Tables 7 and 8). The estimated noncarcinogenic and carcinogenic risks from the inhalation of volatiles and fugitive dust and dermal contact with sediment were within USEPA recommended levels of risk for all commercial populations (Tables 9 through 12). Comparisons of sediment data to effects range-median (ERM) and threshold effects level (TEL) values were performed and are presented in Table 13. None of the contaminants detected in sediment exceeded their respective ERM screening values. One non-detected sediment contaminant (dibenzo[a,h]anthracene) exceeded the corresponding ERM value (0.26 mg/kg) at an assumed concentration equal to one half the detection level (0.295 mg/kg).

3.3 Groundwater

The estimated noncarcinogenic risks from the ingestion of groundwater for all commercial populations exceeded the USEPA recommended levels of risk (Table 14). Perchlorate was not detected in groundwater in any sample collected from the site (1.0 ug/L detection level). The recommended acceptable range is 4 to 18 ug/L (9), therefore, perchlorate in groundwater is not expected to contribute significantly to the overall risk posed by groundwater. See Attachment B for additional information regarding perchlorate toxicity. Aluminum, arsenic, chromium, manganese, and vanadium were the noncarcinogenic risk drivers for construction worker and child visitor populations. Aluminum, arsenic, chromium and vanadium were identified as the risk drivers for the youth visitor population; the risk drivers for the adult worker population were arsenic,

chromium, and vanadium. Carcinogenic risk estimates for the ingestion of groundwater exceeded USEPA recommended levels of risk for all commercial populations (Table 15). Arsenic was identified as the carcinogenic risk driver for all commercial populations. Noncarcinogenic risk estimates for dermal contact with groundwater exceeded the USEPA recommended levels of risk (Table 16) for all commercial populations. Chromium was identified as the noncarcinogenic risk driver for all commercial use populations. No carcinogenic compounds were detected in groundwater; therefore, carcinogenic risks were estimated using nondetected compounds. Carcinogenic risk estimates for dermal exposures to groundwater exceeded USEPA recommended levels for all commercial populations (Table 17). The lack of calculable dermal hazard values for many of the contaminants of concern result from the limited availability of required physical constants (permeability constants (10), oral absorption efficiencies, and dermal absorption factors (11)) for estimating carcinogenic and noncarcinogenic risk. The lack of critical physical constants and the methods for derivation of dermal exposures lead to a high degree of uncertainty associated with this route of exposure. This high degree of uncertainty should be considered when evaluating the hazards of dermal exposure to groundwater.

Groundwater contaminant concentrations were compared to available MCLs. Four detected compounds (arsenic, beryllium, chromium, and lead) were present in groundwater at concentrations that exceeded their respective MCL values (Table 18). Groundwater contaminant concentrations were also compared to available Maryland ambient water quality standards (AWQS) or USEPA recommended ambient water quality criteria (AWQC) (Table 19). Four detected groundwater contaminants (chromium, copper, lead, and zinc) exceeded the AWQS and AWQC for the protection of aquatic life (acute and chronic). Beryllium and selenium exceeded the USEPA recommended AWQC for the protection of aquatic life (chronic). Selenium also exceeded the Maryland AWQS for the protection of aquatic life (chronic). Arsenic and beryllium also exceeded the USEPA recommended AWQC for the protection of human health through fish consumption. The impact of these exceedances and any potential adverse effects to nearby surface water bodies cannot be determined from data available at this time.

3.4 Surface Water

The estimated noncarcinogenic and carcinogenic risks for the child and youth recreational swimmer from the ingestion of surface water while swimming were within the USEPA recommended levels of risk (Tables 20 and 21). Only four compounds (antimony, arsenic, barium, and manganese) were detected in surface water, however, no risk estimates from dermal exposure to surface water could be calculated since no permeability constants were available for these compounds. Therefore, noncarcinogenic and carcinogenic risk estimates for dermal contact with surface water were not calculated.

Surface water contaminant concentrations were also compared to available Maryland ambient water quality standards (AWQS) and USEPA recommended ambient water quality criteria (AWQC) (Table 22). Two detected surface water contaminants (arsenic and methoxychlor) exceeded USEPA recommended AWQC. Arsenic exceeded the

AWQC for the protection of human health through fish consumption and methoxychlor exceeded the AWQC for the protection of aquatic life (chronic).

3.5 Evaluation Assumptions

When determining whether an increased risk to human health exists at this site, it is important to understand that this evaluation was prepared as a first level screening evaluation. Many conservative assumptions are included in this evaluation, which were developed with the understanding that if the estimated risk, using the conservative assumptions, does not exceed USEPA's recommended levels, then the risk estimated using more realistic scenarios will not exceed these levels.

Since this evaluation includes many conservative assumptions, a risk that exceeds USEPA's recommended level of risk does not necessarily indicate an increased risk to human health. When this situation occurs, it is necessary to consider several points when determining if the risk actually does represent a threat to human health. For example, the quantitative risk estimate in this evaluation assumes people will be exposed to a contaminant at the maximum concentration all throughout the site and for the entire exposure duration. These assumptions do not take into account whether the maximum concentration is anomalous or characteristic of the site, or biodegradation, dispersion, dilution, or other factors that may decrease the contaminant concentration throughout the time of exposure.

This evaluation also assumes that the bioavailability of each contaminant is 100 percent, and that all of the contaminant taken into the body is absorbed across the digestive tract into the body. A chemical is harmful to human health only if it is absorbed into the body. Assuming complete bioavailability does not consider the fact that it is common for a fraction of the chemical taken into the body is excreted rather than being absorbed into the body. The bioavailability of a contaminant is dependent on many factors, such as the state or form of the contaminant and if the actual size of the contaminant particle would permit incidental ingestion. These issues must be considered when evaluating the appropriateness of assuming total bioavailability of a contaminant.

4.0 References

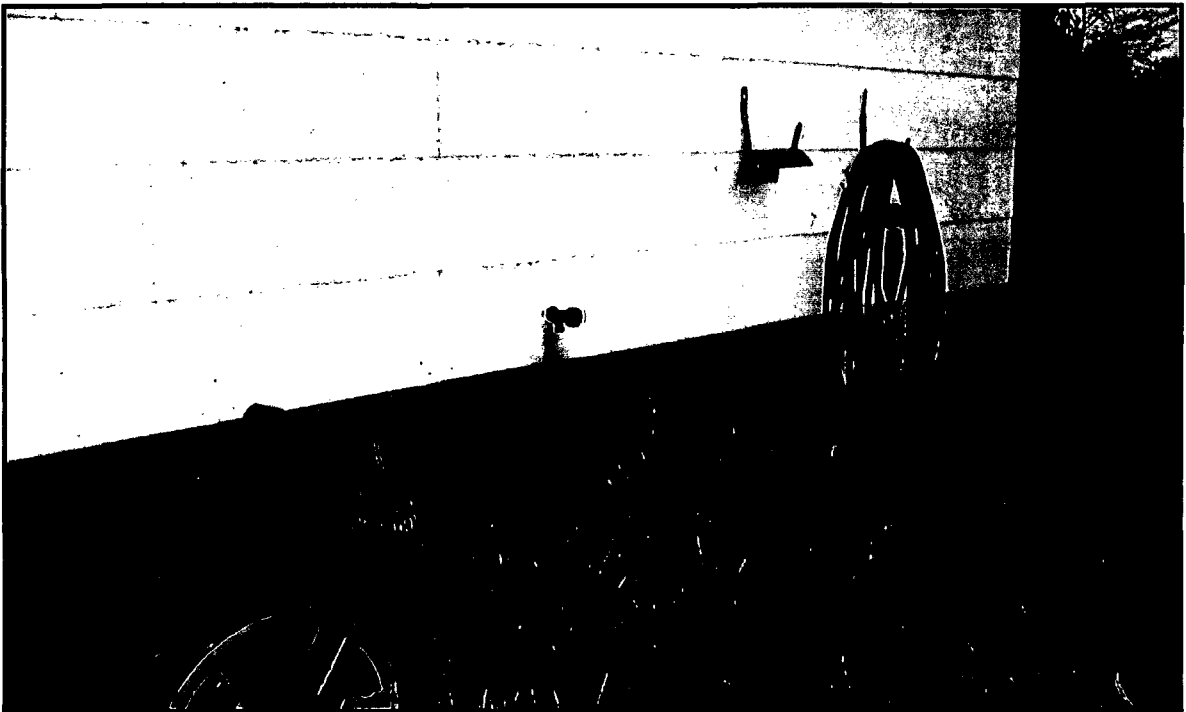
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ORIGINAL
(Red)

10.0 PHOTOGRAPHS

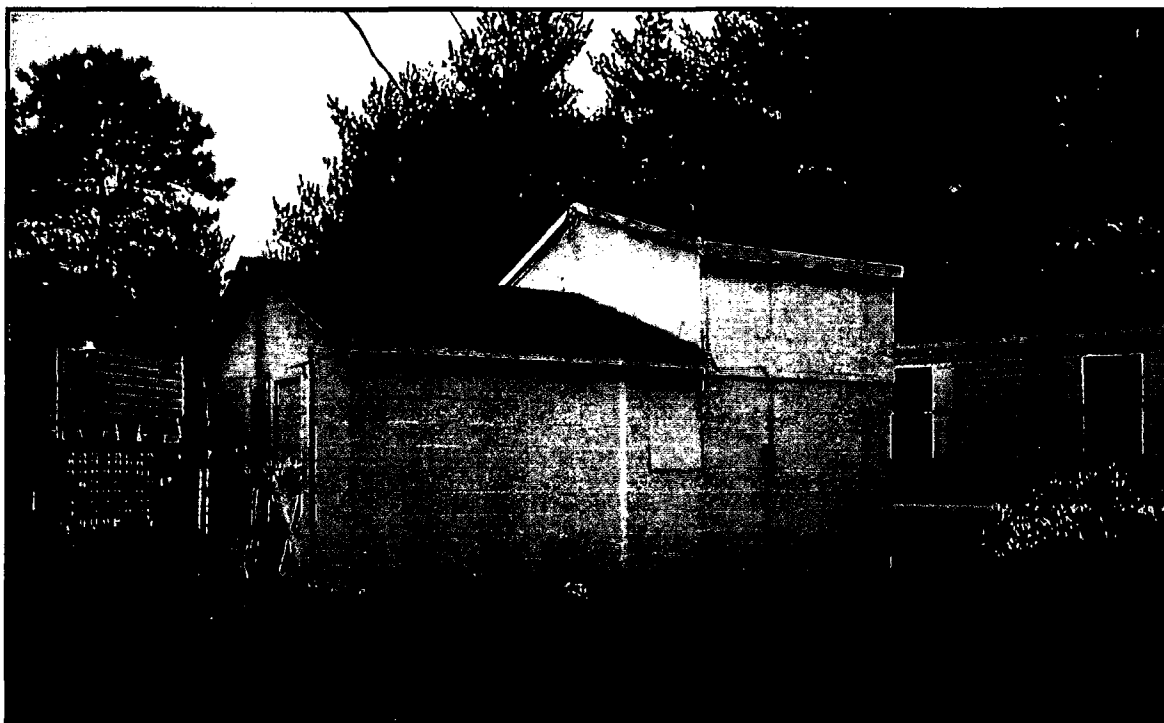


Location of GW-1, spigot at the [REDACTED].



Location of GW-2, spigot at [REDACTED].

ORIGINAL
(Red)



Location of GW-3, well house in the [REDACTED].

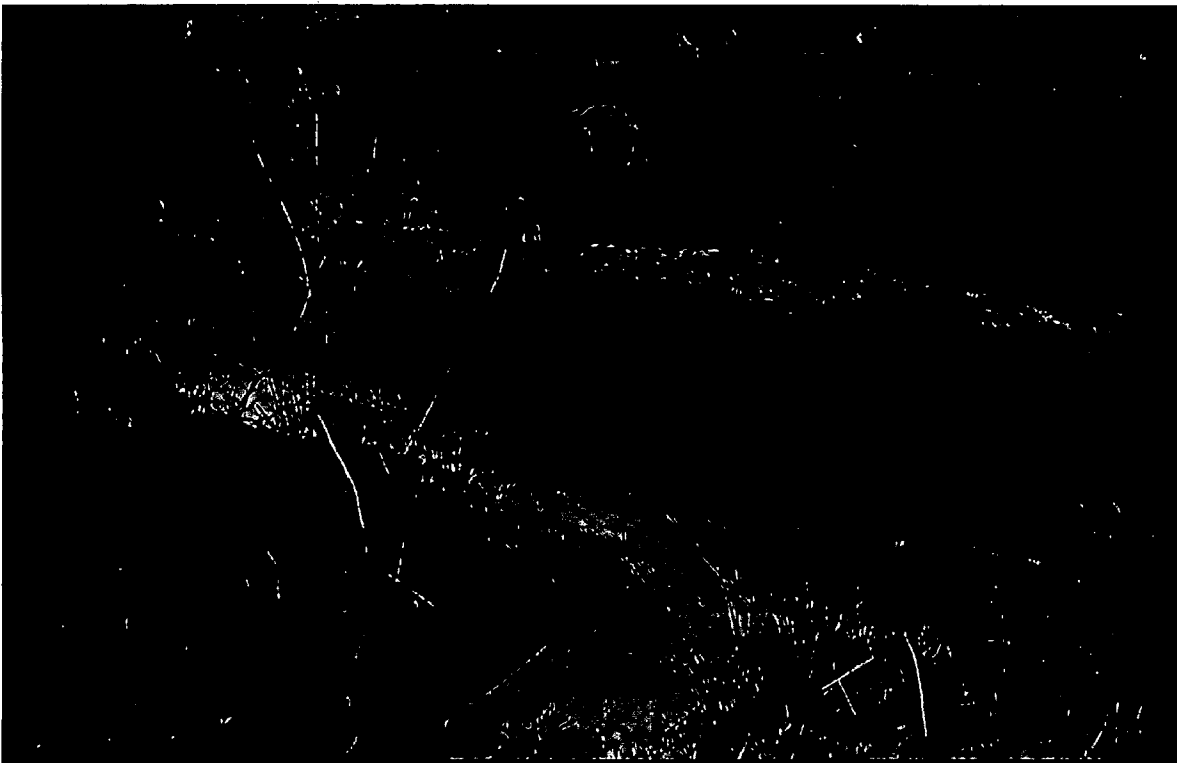


Location of GW-5 and S-7 collected from the waste pile area.

ORIGINAL
(Red)



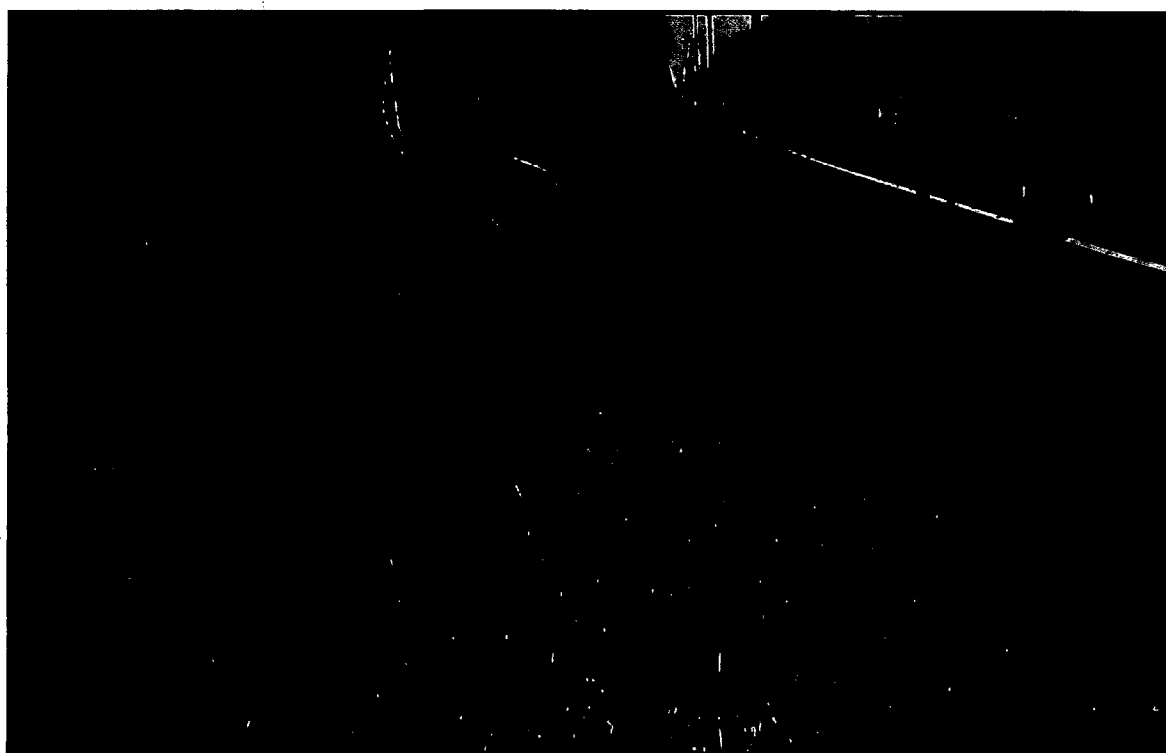
Location of SW-1 collected from Mill Run approximately 20 feet north of Route 7 bridge.



Location of SW-2 and SED-2 collected from Mill Run at washed out road on west end of site.



Location of SW-4/SED-4/SW-5 collected from unnamed stream on the eastern side of site near the former sparkler building.



Location of S-1 collected directly across from the entrance to the site along Route 7.

ORIGINAL
(Red)



Location of S-3 collected from the north side of former AST area.



Location of S-5 collected where a 30-gallon drum containing potassium perchlorate was observed during the May 1999 site visit.

ORIGINAL
(Red)



Location of S-8 collected from the waste pile area.



Location of S-9 collected approximately 20 feet southwest of S-8 in the waste pile area.

ORIGINAL
(Red)

APPENDIX I

TARGET ANALYTE LIST

Volatile Organic Compounds

1,1,1-Trichloroethane	Acetone
1,1,2,2-Tetrachloroethane	Benzene
1,1,2-Trichloro-1,2,2-trifluoroethane	Bromodichloromethane
1,1,2-Trichloroethane	Bromoform
1,1-Dichloroethane	Bromomethane
1,1-Dichloroethene	Carbon Disulfide
1,2,4-Trichlorobenzene	Carbon Tetrachloride
1,2-Dibromo-3-chloropropane	Chlorobenzene
1,2-Dibromoethane	Chloroethane
1,2-Dichlorobenzene	Chloroform
1,2-Dichloroethane	Chloromethane
1,2-Dichloroethene (cis)	Cyclohexane
1,2-Dichloroethene (trans)	Dibromochloromethane
1,2-Dichloropropane	Dichlorodifluoromethane
1,3-Dichlorobenzene	Ethylbenzene
1,3-Dichloropropene (cis)	Isopropylbenzene
1,3-Dichloropropene (trans)	Methyl Acetate
1,4-Dichlorobenzene	Methyl tert-Butyl Ether
2-Butanone	Methylcyclohexane
2-Hexanone	Methylene Chloride
4-Methyl-2-Pentanone	Styrene
	Tetrachloroethene
	Toluene
	Trichloroethene
	Trichlorofluoromethane
	Vinyl Chloride
	Xylenes (total)

Semi-Volatile Organic Compounds

1,1'-Biphenyl	Acenaphthene	Di-n-octylphthalate
2,2-oxybis(1-Chloropropane)	Acenaphthylene	Fluoranthene
2,4,5-Trichlorophenol	Acetophenone	Fluorene
2,4,6-Trichlorophenol	Anthracene	Hexachlorobenzene
2,4-Dichlorophenol	Atrazine	Hexachlorobutadiene
2,4-Dimethylphenol	Benzaldehyde	Hexachlorocyclopentadiene
2,4-Dinitrophenol	Benzo(a)anthracene	Hexachloroethane
2,4-Dinitrotoluene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene
2,6-Dinitrotoluene	Benzo(b)fluoranthene	Isophorone
2-Chloronaphthalene	Benzo(g,h,i)perylene	Naphthalene
2-Chlorophenol	Benzo(k)fluoranthene	Nitrobenzene
2-methylnaphthalene	bis(2-Chloroethoxy)methane	N-Nitroso-di-n-propylamine
2-Methylphenol	bis-(2-Chloroethyl)ether	N-Nitrosodiphenylamine
2-Nitroaniline	bis(2-Ethylhexyl)phthalate	Phenanthrene
2-Nitrophenol	Butylbenzylphthalate	Phenol
3,3'-Dichlorobenzidine	Caprolactam	Pyrene
3-Nitroaniline	Carbazole	
4,6-Dinitro-2-methylphenol	Chrysene	
4-Bromophenyl-phenyl ether	Dibenzo(a,h)anthracene	
4-Chloro-3-methylphenol	Dibenzofuran	
4-Chloroaniline	Diethylphthalate	
4-Chlorophenyl-phenyl ether	Dimethylphthalate	
4-Methylphenol	Di-n-butylphthalate	
4-Nitroaniline		
4-Nitrophenol		

Pesticides and PCBs

4,4'-DDD
4,4'-DDE
4,4'-DDT
Aldrin
alpha-BHC
alpha-Chlordane
Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor-1242
Aroclor-1248
Aroclor-1254
Aroclor-1254
beta-BHC
delta-BHC
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan sulfate
Endrin
Endrin aldehyde
Endrin ketone
gamma-BHC (Lindane)
gamma-Chlordane
Heptachlor
Heptachlor epoxide
Methoxychlor
Toxaphene

Inorganic Compounds

Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium (total)
Cobalt
Copper
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc
Cyanide